Rockets, Reactions & Ratios
Stoichiometry

Introduction

Recall that a chemical equation is the recipe for a reaction. The coefficients in the balanced equation provide the *whole number* mole ratio of reactants and products. In the same way that a recipe can be doubled, tripled or halved so can a reaction. Real life reactions become challenging because the ratio of reactants and products are often presented in a decimal form or in a unit other than moles. To add even more challenge, often the ingredients are not supplied in perfect amounts. If a batch of chocolate chip cookies requires 2 eggs and you have a dozen do you just put them all in and hope your cookies come out okay? Even though the reaction will always maintain the mole ratio, you must recognize if you have too much (excess) or too little (limiting) of any reactant. Stoichiometry, the study of mathematical relationships in a reaction, employs dimensional analysis as a process for solving these trickier problems.

Review

1. Review the previous handouts regarding "Rockets, Reactions & Ratios." The reaction involved is a double replacement that is immediately followed by the decomposition of an acid. Use your lab notes and class notes on types of reactions and predicting products to write the two reactions and the overall equation that occurred. Include states of matter.

   A. Double Replacement: _____

   B. Decomposition:_____

   C. Overall: _____

Analysis

1. Vinegar is a solution of approximately 5% acetic acid in water. This is a volume percent (v/v) which means there is 5 ml of acetic acid per 100 ml of vinegar. The density of acetic acid is 1.05 g/ml. Use dimensional analysis to determine how many grams of acetic acid are present in 15.0 ml of vinegar.

2. What is the molar mass of acetic acid? Show all work

3. What is the molar mass of sodium bicarbonate? Show all work

4. Using dimensional analysis, determine the perfect amount of baking soda in grams needed to react with the grams of acetic acid in 15.0 ml of vinegar (your answer to analysis question 1). Show all work.

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5. Record the amount of baking soda your group used in the competition of "Rockets, Reactions & Ratios"

6. Circle one: Our baking soda was the limiting / excess / perfect amount of reactant.

7. If the baking soda was limiting, how much more was needed to use up all of the acetic acid? Show work.

8. If the baking soda was in excess, how many grams were in excess? Show work.

9. Consider the class data collected during the competition, many groups were able to be successful even though the baking soda was limiting. Provide a reasonable explanation for this observation.

10. Do you think the presence of excess baking soda could affect the results of the competition? Explain.

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